

### CLAIMS

- 1) A method of encoding a data byte, comprising the steps of:  
selecting an irreducible polynomial;  
generating an error control code as a function of the polynomial and the data; and  
generating an encoded data matrix wherein the data and the error control code  
comprise the elements of the matrix  
dispersing an element of the encoded data matrix to a selected one of a plurality  
of channels based upon a position of the element in the matrix.
- 2) The method of claim 1, wherein:  
the polynomial is selected as a irreducible polynomial.
- 3) The method of claim 1, wherein:  
the error control code is the same length as the data byte.
- 4) The method of claim 2, wherein the data is digitally represented by eight bits and  
further wherein:  
the polynomial is selected as an eighth degree polynomial.
- 5) The method of claim 4, wherein the polynomial is in the form of  
 $1+x^3+x^4+x^5+x^8$ .
- 6) The method of claim 4, wherein the polynomial is in the form of  
 $1+x+x^2+x^4+x^6+x^7+x^8$ .
- 7) The method of claim 1, wherein the error control code is generated by dividing  
the data by the polynomial, the error control code being the remainder modulo the  
polynomial.
- 8) The method of claim 1, wherein six pair combinations of row elements can be  
equated to a data row element pair.
- 9) The method of claim 1, wherein six pair combinations of column elements can be  
equated to a data row element pair.
- 10) The method of claim 1, wherein pair combinations of elements can be equated to  
any other pair of elements.
- 11) The method of claim 1, comprising the further steps of forming a second error  
control code of two additional row elements, whereby further pair combination of

row elements or column elements can be equated to any other pair combination of row elements or column elements.

- 12) The codeword of claim 1 wherein each codeword element is sent to a separate device.
- 13) A method of encoding data in the form of a data byte  $D_i = d_0d_1d_2d_3d_4d_5d_6d_7$  comprising the steps of:  
selecting an irreducible error correcting eighth degree polynomial;  
dividing the data byte by the polynomial to produce an error correction code in the form  $E_i = e_0e_1e_2e_3e_4e_5e_6e_7$ ; and  
generating an encoded data word in the form  $d_0d_1d_2d_3d_4d_5d_6d_7e_0e_1e_2e_3e_4e_5e_6e_7$ .
- 14) The method of claim 13, wherein the polynomial is in the form of  $1+x^3+x^4+x^5+x^8$ .
- 15) The method of claim 13, wherein the polynomial is in the form of  $1+x+x^2+x^4+x^6+x^7+x^8$ .
- 16) The method of claim 13, wherein the error control code is generated by dividing the data by the polynomial, the error control code being the remainder modulo the polynomial.
- 17) The method of claim 13, comprising the further step of:  
forming the encoded data word as an array.
- 18) The method of claim 17, wherein multiple data bytes are encoded and formed as encoded data words, the encoded data words being formed into an array of arrays.
- 19) The method of claim 18, further comprising:  
forming a error detection code for every element in the rows and columns of the array of arrays.
- 20) The method of claim 19, wherein error recovery is desired and is accomplished by the further steps of:  
counting errors in a codeword in a column;  
counting errors in a codeword in a row;  
using row equations to correct errors if the number of row errors is less than row errors;

using column equations otherwise.

- 21) The method of claim 19, wherein error recovery is desired and is accomplished by the further steps of:  
counting errors in a codeword in a column;  
counting errors in a codeword in a row;  
using row equations to correct errors if the number of row errors is less than or equal to column errors;  
using column equations otherwise.
- 22) The method of claim 17, comprising the  
forming the encoded data word as a 4x4 array.
- 23) The method of claim 17, comprising the further step of:  
forming the encoded data word as a 3x4 array.
- 24) The method of claim 17, comprising the further step of:  
forming the encoded data word as a 4x3 array.
- 25) The method of claim 17, comprising the further step of:  
arranging the matrix so that each element of the data byte is horizontally or vertically adjacent to at least three other elements of the data byte.
- 26) The method of claim 17, comprising the further step of:  
arranging the matrix so that each element of the data byte and the error control byte is a row of the matrix.
- 27) The method of claim 17, comprising the further step of:  
forming the encoded data matrix as  
d0d1d2d3  
d4d5d6d7  
e0e1e2e3  
e4e5e6e7 .
- 28) The method of claim 27, comprising the further steps of :  
dispersing the first row of the matrix to a first device;  
dispersing the second row of the matrix to a second device;  
dispersing the third row of the matrix to a third device;  
dispersing the fourth row of the matrix to a fourth device; and

dispersing each column of the matrix to one of the first through fourth devices such that only one column from the matrix is stored on any of the first through fourth storage devices.

- 29) The method of claim 28, wherein in the event that up to two of the devices fails, a method of recovering lost data includes the step of:

determining which of the first through fourth devices that has not failed and contains error correction codes for data on a drive that has failed;

retrieving the dispersed combination of error correction codes and data from the device so selected;

recreating data dispersed to a failed device using the known data and error correction codes in the equations below to recreate lost data

$$e0 = d0 + d3 + d4 + d5 + d6$$

$$e1 = d1 + d4 + d5 + d6 + d7$$

$$e2 = d2 + d5 + d6 + d7$$

$$e3 = d0 + d4 + d5 + d7$$

$$e4 = d0 + d1 + d3 + d4$$

$$e5 = d0 + d1 + d2 + d3 + d6$$

$$e6 = d1 + d2 + d3 + d4 + d7$$

$$e7 = d2 + d3 + d4 + d5.$$

- 30) The method of claim 29, wherein in the event that up to two of the devices fails, a method of recovering lost data includes the step of:

determining which of the first through fourth devices that has not failed and contains error correction codes for data on a drive that has failed;

retrieving the dispersed combination of error correction codes and data from the device so selected;

recreating data dispersed to a failed device using the known data and error correction codes in the equations below to recreate lost data

$$e0 = d0 + d1 + d3 + d6$$

$$e1 = d0 + d2 + d3 + d4 + d6 + d7$$

$$e2 = d0 + d4 + d5 + d6 + d7$$

$$e3 = d1 + d5 + d6 + d7$$

$$e4 = d0 + d1 + d2 + d3 + d7$$

$$e5 = d1 + d2 + d3 + d4$$

$$e6 = d0 + d1 + d2 + d4 + d5 + d6$$

$$e7 = d0 + d2 + d5 + d7.$$

- 31) A method of encoding a data byte, comprising the steps of:  
selecting an irreducible polynomial;  
generating a first error control code as a function of the polynomial and the data;  
generating a second error control code as a function of the polynomial and the data;  
generating an encoded first data matrix wherein the data and the first error control codes comprise the elements of the matrix;  
generating an encoded second data matrix wherein the data and the first and second error control codes comprise elements of the matrix; and  
dispersing an element of the encoded data matrix to a selected one of a plurality of channels based upon a position of the element in the matrix.
- 32) A method of encoding a data byte, comprising the steps of:  
selecting an irreducible polynomial;  
generating an error control code as a function of the polynomial and the data;  
generating an encoded data matrix wherein the data and the error control code comprise the elements of the matrix; and  
dispersing an element of the encoded data matrix to a selected one of a plurality of channels based upon a position of the element in the matrix.
- 28) The method of encoding a data byte of claim 27, wherein multiple databytes are encoded as codewords and the codewords are